REMARKS/ARGUMENTS

Claims 1-20 are pending in the application. The Applicant hereby requests further examination and reconsideration of the application in view of the foregoing amendments and these remarks.

In paragraph 2, the Examiner rejects claims 1-3, 5, 6, and 17-20 under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 6,160,651 ("Chang") in view of U.S. Patent No. 5,786,916 ("Okayama") and rejects claim 4 under 35 U.S.C. §103(a) as obvious over Chang in view of Okayama and further in view of U.S. Patent No. 6,646,989 ("Khotimsky").

For the following reasons, the Applicant submits that claims 1-6 and 17-20 are allowable over Chang, Okayama, and Khotimsky.

Claim 1 recites:

1. A method of determining a path between an ingress node and an egress node in a packet network for a new demand, the method comprising the steps of:

(a) generating a graph for the packet network integrating logical and optical layers as nodes and links of the graph, wherein each node of the graph accounts for presence or absence of wavelength conversion within the node;

(b) modifying the graph, if necessary, based on the new demand and any previously routed demands; and

(c) determining a route through the modified graph as the path for the new demand.

An example of step (a) is illustrated in the graph of FIG. 3, where wavelength conversion is present in nodes N1, N2, and N4. That is, in the model for each of these nodes, a respective "super-node" (N11, N21, and N41) performs a conversion between wavelengths λ_1 and λ_2. On the other hand, wavelength conversion is absent in node N3, which does not contain a super-node because it does not allow for conversion between wavelengths λ_1 and λ_2. Thus, for each node, the graph contains both (i) a list of each wavelength that may be used for both incoming and outgoing connections at the node (i.e., each of nodes N1-N4 can use wavelengths λ_1 and λ_2 for both incoming and outgoing connections), and (ii) a list of the available conversions from one wavelength to another at the node, i.e., for each of nodes N1, N2, and N4, if wavelength λ_1 is used for an incoming connection, then either wavelength λ_1 or λ_2 can be used for the corresponding outgoing connection; and, for each of nodes N1, N2, and N4, if wavelength λ_2 is used for an incoming connection, then either wavelength λ_1 or λ_2 can be used for the corresponding outgoing connection. However, for node N3, if λ_1 is used for an incoming connection, then only λ_1 can be used for the corresponding outgoing connection.

As the Examiner correctly acknowledges on p. 2, "Chang fails to disclose [that] each node of the graph accounts for presence or absence of wavelength conversion with[in] the node." In fact, nowhere does Chang teach, disclose, or even suggest the desirability of generating a graph to model the network. Instead, Chang's "connection table" discussed in connection with FIG. 5, to which the Examiner refers, is actually a look-up table for a single node, with one such look-up table provided at each node. At col. 14, line 48 to col. 15, line 15, Chang explains as follows:

> NC&M 520 is further arranged so that it may assign the label-switch state to each packet incoming to a network element from a client interface--the label-switch state is appended by Plug & Play module 432 and, for the purposes of the present discussion, the label-switch state is commensurate with header 510 (see FIG. 5). The label-switch state is computed by NC&M 520 and downloaded to each network element 801-807 in the form of a local routing table. With reference to FIG. 9, there is shown network element 801 and its embedded switch 901 in pictorial

form. Also shown is incoming optical fiber 902, with delay loop 903, carrying packet 920 composed of header 510 and payload 511--payload 511 in this case is packet 820 from FIG. 8. Fiber 9022 delivers a delayed version of packet 920 to network element 801. Also, a portion of the light energy appearing on fiber 902 is tapped via fiber 9021 and inputted to optical module 710 which processes the incoming packet 920 to detect header 510--header 510 for packet 920 is shown as being composed of the label-switch state '11101011000', identified by reference numeral 915. Also shown in FIG. 9 is local look-up table 910, being composed of three columns, namely, "Label-switch State" (column 911), "Local Address" (column 912), and "Priority Level" (column 913). The particular label-switch state for packet 920 is cross-referenced in look-up table 910 to determine the routing of the incoming packet. In this case, the label-switch state for packet 920 is the entry in the fourth row of look-up table 910. The local switch address ("Local Address of column 911) corresponding to this label-switch state is "0111", which is interpreted as follows: the first two binary digits indicate the incoming port, and the second two binary digits indicate the output port. In this case, for the exemplary four-input, four-output switch, the incoming packet is to be routed from input port "01" to output port "11", so switch 901 is switched accordingly (as shown) [emphasis added].

Even assuming, *arguendo*, that the aggregate of the look-up tables at all of the nodes could be considered a "graph," the model of Chang accounts only for (i) a label-switch state, (ii) a local address, and (iii) a priority level. Accordingly, Chang still fails to teach a list indicating the presence or absence of wavelength conversion within each node.

The Examiner attempts to supply the missing teachings using Okayama. However, Okayama falls completely short of the mark. Okayama discloses various optical-wavelength-interchange elements and devices, each of which receives a light signal at a first wavelength and outputs a light signal at a second wavelength (Abst.; col. 1, lines 46-51; col. 3, lines 49-65). Of course, since Okayama discloses elements and devices for optical-wavelength interchange, Okayama discloses optical devices that actually perform the wavelength conversion. However, just as with Chang, nowhere does Okayama teach, disclose, or even suggest the desirability of generating a graph to model the network. Since Okayama does not involve generating a graph, Okayama cannot possibly disclose that "each node of the graph accounts for presence or absence of wavelength conversion within the node."

Since neither Chang nor Okayama discloses generating a graph according to step (a) of claim 1, neither of these references can possibly disclose step (b), which is "modifying the graph, if necessary, based on the new demand and any previously routed demands" or step (c), which is "determining a route through the modified graph as the path for the new demand."

Khotimsky, which the Examiner cites in rejecting claim 4, teaches a hop-by-hop routing method. Khotimsky makes no mention of optical cross-connects, wavelengths, or even optical devices and also fails to supply any of the teachings of steps (a), (b), or (c).

Since Chang, Okayama, and Khotimsky, whether taken alone or in combination with one another, fail to teach steps (a), (b), and (c), claim 1 is allowable over Chang, Okayama, and Khotimsky. For similar reasons, the Applicant submits that claims 18 and 20 are also allowable over Chang, Okayama, and Khotimsky. Since claims 2-6, 17, and 19 depend variously from claims 1 and 18, it is further submitted that those claims are also allowable over Chang, Okayama, and Khotimsky.

The Applicant submits therefore that the rejections of claims under Section 103 have been overcome.

Claims 2 and 3

Claims 2 and 3 are also allowable for their own additional features, none of which are disclosed, taught, or suggested by Chang, Okayama, or Khotimsky, as follows:

Claim 2 recites that each node and link of the graph is present in the graph based on a residual capacity of each wavelength of each optical link. As explained in the specification beginning at p. 12, line 12, "[w]hen a particular wavelength of each link between nodes of the path carries r_d units of the demand, a residual capacity c_r, of $(1-r_d)$ units of bandwidth is available in that wavelength for future demands." Chang merely discloses modeling whether a given wavelength is currently available for incoming and outgoing connections at a given node (col. 11, lines 8-18), but does not disclose modeling residual capacity as units of bandwidth available for future demands. Nor do Okayama or Khotimsky disclose computing such a residual capacity.

Claim 3 recites that each node is modeled based on whether it is a router, an optical cross-connect (OXC) with wavelength conversion, or an OXC without wavelength conversion, and that each available wavelength of an optical link between nodes is modeled in the graph with a corresponding link in the graph. As discussed above with respect to claim 1, neither Chang, Okayama, nor Khotimsky discloses modeling nodes based on whether or not wavelength conversion exists at that node.

The Applicant submits therefore that the above discussion provides additional reasons for the assertion that claims 2 and 3 are allowable over the cited references.

In paragraph 4, the Examiner indicates that claims 7-16 would be allowable if rewritten to include all of the limitations of the base claim and any intervening claims. However, the Applicant submits that all of the now-pending claims are allowable over the prior art of record and respectfully requests that the Examiner reconsider the pending art rejections in view of the above amendments and remarks.

Therefore, the Applicant believes that the entire application is now in condition for allowance, and early and favorable action is respectfully solicited.

Respectfully submitted,

Date: 5/26/06

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